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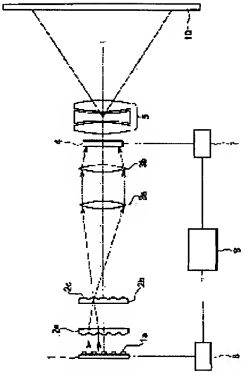
(54) PROJECTION-TYPE DISPLAY APPARATUS

(57)Abstract:
PROBLEM TO BE SOLVED: To make a projection-type display apparatus small in size and light in weight, to realize bright color displays, without making power consumption higher and to prevent sound from being produced at projection.
SOLUTION: This projection-type display apparatus is equipped with a light source 1, a light modulating device 4 modulating light from the light source 1, and a projection lens 5 which projects the light modulated by the device 4. Then, the light source 1 is constituted of a light-emitting element array, constituted by arranging plural light emitting elements 1a in an array state, and light-diffusing means 2a and 2b causing the entire light modulating area of the device 4 to be irradiated with the right emitted from the individual light- emitting elements 1a.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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CLAIMS

[Claim(s)]
[Claim 1] The projection mold display characterized by coming to have an optical diffusion means are the light source, the light-modulation equipment which modulate the light from this light source, and the projection mold display equipped with the projector lens which projects the light modulated by this light-modulation equipment, and make the light to which said light source becomes from the light emitting device array which comes to allot two or more light emitting devices in the shape of an array, and outgoing radiation is carried out from each light emitting device irradiate the whole light-modulation field of said light-modulation equipment, respectively.
[Claim 2] The projection mold display according to claim 1 characterized by coming to have at least one pair of fly eye lens by which two or more small lenses with which a profile has an abbreviation rectangle-like convex were arranged in the shape of an array as said optical diffusion means.
[Claim 3] The projection mold display according to claim 2 with which light by which the array of the light emitting device in said light emitting device array and the array of the small lens in said fly eye lens are in agreement, and outgoing radiation is carried out from each light emitting device of said light emitting device array is characterized by carrying out incidence to one small lens of each of the fly eye lenses of said pair, respectively.
[Claim 4] A projection mold display given in either of claims 2 or 3 characterized by the core of the flux of light by which outgoing radiation is carried out from at least one light emitting device among each light emitting devices in said light emitting device array differing from the center position of the small lens of one [said] fly eye lens with which incidence of this flux of light is carried out while incidence of the light by which outgoing radiation is carried out from said light emitting device array is carried out to one side of the fly eye lenses of said pair.
[Claim 5] The projection mold display according to claim 1 to 4 characterized by the luminescence reinforcement of the light emitting device allotted to the location near the periphery section of a light emitting device array among said two or more light emitting devices which can be set to said light emitting device array being stronger than the luminescence reinforcement of the light emitting device arranged in the location near the center section of the light emitting device array.
[Claim 6] The projection mold display according to claim 1 to 5 characterized by coming to have the light modulation equipment driving means which gives light modulation which said light emitting device array consists of two or more light emitting devices from which the luminescent color differs, drives said light modulation equipment while having the light source driving means which carries out sequential luminescence of said two or more light emitting devices for said every luminescent color, and is different for said every luminescent color.
[Claim 7] The projection mold display according to claim 1 to 5 characterized by coming to have a light guide means to lead the light by which outgoing radiation is carried out from these two or more light emitting device arrays, respectively to a single optical path, the light source driving means which carries out sequential luminescence of said two or more light emitting device arrays, and the light modulation equipment driving means which gives light modulation which drives said light modulation equipment and is different for said every luminescent color while having two or more light emitting device arrays from which the luminescent color differs as said light source, respectively.
[Claim 8] The projection mold display according to claim 7 characterized by said light guide means being a cross dichroic prism.
[Claim 9] The projection mold display according to claim 1 to 8 characterized by equipping said light modulation equipment with a liquid crystal panel.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to projection mold displays, such as projector equipment.
[0002]
[Description of the Prior Art] A projection mold display is developed as an image display device which two or more persons can see to coincidence, and the object for presentations in recent years, for example, a meeting, etc. is put in practical use. A projection mold display modulates light source light with the light modulation equipment which used the liquid crystal panel, makes it image light, and projects and displays this image light on the image display sections, such as a screen.
[0003] Drawing 7 is the outline block diagram having shown an example of the conventional projection mold display. The light source lamps 211 which the equipment of this example performs color display with a color serial mode, and emit light in the white light, such as a halogen lamp and a metal halide lamp, The concave mirror 212 which makes the synchrotron orbital radiation by which outgoing radiation was carried out an almost parallel bundle of rays, and carries out outgoing radiation from the light source lamp 211, The color wheel 215 which divides the outgoing radiation light from the light source lamp 211 into two or more colored light, The condenser lens 213 which condenses the outgoing radiation light from the light source lamp 211 on the color filter attached by the color wheel 215, The outline configuration is carried out from the light modulation equipment 216 of the transparency mold which modulates the colored light separated by the color wheel 215, the condenser lens 214 which leads the colored light separated by the color wheel 215 to light modulation equipment 216, and the projector lens 217 which projects the light modulated by light modulation equipment 216. The example of a color wheel 215 is shown in drawing 8 . It is disc-like and red (R), green (G), and the color filters 215a, 215b, and 215c that penetrate only each blue (B) colored light are arranged along the hoop direction, and the color wheel 215 of this example is constituted so that it may rotate to a hoop direction at high speed. Moreover, while being constituted so that light modulation equipment 216 may be equipped with an incidence side polarizing plate, a liquid crystal panel, and an outgoing radiation side polarizing plate, incident light may be modulated according to the given picture signal and outgoing radiation of the image light may be carried out, the rotational speed of a color wheel is set up so that it may synchronize with the frame display of an image. In the projection mold display of this example, in case the light by which outgoing radiation was carried out from the light source lamp 211 penetrates the color wheel 215 which is carrying out high-speed rotation, it is divided into the colored light of three colors of R, G, and B in time sharing. Therefore, while each colored light of three colors of R, G, and B changes at high speed, incidence is carried out to light modulation equipment 216, and while the image of each colored light changes at high speed, it is projected on a screen 218. And color display is realized by mixing on the retina of those who see and making the image of three colors perceive as a color of arbitration.
[0004]
[Problem(s) to be Solved by the Invention] However, since the light source lamps 211 well used for the conventional projection mold display, such as a halogen lamp and a metal halide lamp, were comparatively large-sized and heavy, they had the fault that the whole equipment became on a large scale and heavy. Moreover, since generation of heat of a lamp was large, it needed to cool by the fan and had become the cause of noise generating. Furthermore, the fault that the means for preventing the burst of a lamp had to be established also had the sensor which acts as the monitor of the temperature of a lamp. Moreover, since the permeability of the color filters 215a, 215b, and 215c of a color wheel 215 was not not much high when performing color display of

a color serial mode using a color wheel 215 like the equipment of the above-mentioned example, when the use effectiveness of light source light was bad and tended to obtain the bright image, there was a problem that power consumption increased. Furthermore, since the sound was generated when a color wheel 215 rotated, there was also dissatisfaction of being jarring. Therefore, the purpose of this invention aims at attaining miniaturization of a projection mold display, and lightweight-ization, realizing bright color display, without increasing power consumption, and preventing sound generating at the time of projection.

[0005]

[Means for Solving the Problem] In order to solve said technical problem the projection mold display of this invention They are the light source, the light modulation equipment which modulates the light from this light source, and the projection mold display equipped with the projector lens which projects the light modulated by this light modulation equipment. Said light source consists of a light emitting device array which comes to allot two or more light emitting devices in the shape of an array, and it is characterized by coming to have an optical diffusion means to make the light by which outgoing radiation is carried out from each light emitting device irradiate the whole light modulation field of said light modulation equipment, respectively. While being able to attain miniaturization of equipment, lightweight-izing, and reduction-ization of drive power by having used the above-mentioned light emitting device array as the light source according to the projection mold display of this invention, the high projection image of little display grace of brightness nonuniformity and color nonuniformity is obtained by using the above-mentioned optical diffusion means. It is desirable to use at least one pair of fly eye lens by which two or more small lenses with which a profile has an abbreviation rectangle-like convex were arranged in the shape of an array as said optical diffusion means. Moreover, it is desirable that the light by which the array of the light emitting device in said light emitting device array and the array of the small lens in said fly eye lens are made in agreement, and outgoing radiation is carried out from each light emitting device of said light emitting device array constitutes so that incidence may be carried out to one small lens of each of the fly eye lenses of said pair, respectively. Moreover, the core of the flux of light by which outgoing radiation is carried out from each light emitting device in said light emitting device array in case incidence of the light by which outgoing radiation is carried out from said light emitting device array is carried out to one side of the fly eye lenses of said pair, With the center position of the small lens of a fly eye lens with which incidence of this flux of light is carried out So that it is not necessary to make it not necessarily in agreement and the core of the flux of light by which outgoing radiation is carried out from one light emitting device may differ from the center position of the small lens of a fly eye lens with which incidence of this flux of light is carried out Both the location of a light emitting device, and both [either or] of a small lens can also be shifted, and this can raise the homogeneity of the lighting to light modulation equipment. Moreover, as two or more light emitting devices which constitute a light emitting device array, using that from which luminescence reinforcement differs, the luminescence reinforcement of a light emitting device is so weak that it is close to the center section of the light emitting device array, and light modulation equipment can be illuminated more to homogeneity by arranging so that the luminescence reinforcement of a light emitting device may become strong, so that it becomes close to the periphery section. By illuminating light modulation equipment to homogeneity, the nonuniformity of brightness and the nonuniformity of a color in a projection image can be reduced, and the good display of color reproduction nature is obtained by high contrast.

[0006] Moreover, a color serial mode can realize color display by said light emitting device array's consisting of two or more light emitting devices from which the luminescent color differs, and considering as the configuration which established the light modulation equipment driving means which gives light modulation which drives said light modulation equipment and is different for said every luminescent color, while establishing the light source driving means which carries out sequential luminescence of said two or more light emitting devices for said every luminescent color, without being based on the method using the conventional color wheel. Therefore, while being able to raise the use effectiveness of light source light, a high-speed response is possible, and there is no generating of a sound at the time of projection, and quiet equipment is obtained. Or while preparing two or more light emitting device arrays from which the luminescent color differs as said light source, respectively A light guide means to lead the light by which outgoing radiation is carried out from these two or more light emitting device arrays, respectively to a single optical path, Also by the configuration which established the light source driving means which carries out sequential luminescence of said two or more light emitting device arrays, and the light modulation equipment driving means which gives light modulation which drives said light modulation equipment and is different for said every luminescent color A color serial mode can realize color display, without being based on the method using the conventional color wheel. As said light guide

means, it is desirable to use a cross dichroic prism. Moreover, as said light modulation equipment, the thing equipped with the liquid crystal panel is desirable.
[0007]
[Embodiment of the Invention] Hereafter, this invention is explained in detail. Drawing 1 is the outline top view having shown 1 operation gestalt of the projection mold display of this invention. The projection mold display of this operation gestalt is equipped with the light emitting device array 1 as the light source, fly eye lens 2a of a pair and 2b, two lenses 3a and 3b, light modulation equipment equipped with the liquid crystal panel 4, the projection lens system 5, the light source driving means 6, the light modulation equipment driving means 7, and the control means 8 that controls the light source driving means 6 and the light modulation equipment driving means 7. Moreover, although not illustrated, the incidence side polarizing plate and the outgoing radiation side polarizing plate are prepared in the incidence [of a liquid crystal panel 4], and outgoing radiation side, respectively, and light modulation equipment mainly consists of this incidence side polarizing plate, a liquid crystal panel 4, and an outgoing radiation side polarizing plate.
[0008] Drawing 2 is the outline top view having shown an example of the light emitting device array 1. The light emitting device array 1 has the configuration with which two or more light emitting device 1a, such as light emitting diode and a laser diode, was arranged in the shape of [of a m line xn train] an array. With this operation gestalt, although the example of five-line four trains is illustrated, much light emitting device 1a is arranged in fact. In this operation gestalt, red light emitting device 1ar and the red (R) luminescent color are used for the luminescent color, and light emitting device 1a of three blue (B) colors of light emitting device 1ab is used for green light emitting device 1ag and the green (G) luminescent color, and it is regularly arranged so that the light emitting devices of the luminescent color same on the light emitting device array 1 of one sheet may not adjoin each other. For example, the array pattern of light emitting device 1a of three colors in the example of drawing 2 serves as a mosaic array as used in the field of a color filter. And light emitting device 1ar of each color (R, G, B) of the light emitting device array 1, 1ag, and 1ab are controlled by the light source driving means 6 to carry out sequential luminescence for every luminescent color. That is, the light emitting device of the same luminescent color emits light to coincidence, and it consists of light emitting device arrays 1 so that outgoing radiation of the light of a different color may be carried out serially. From each light emitting device 1a of the light emitting device array 1, outgoing radiation of the almost parallel light is carried out toward fly eye lens 2a.
[0009] Drawing 3 is fly eye lens 2a and the perspective view having shown an example of 2b. Fly eye lens 2a and 2b have the configuration with which two or more small lens 2c of the configuration which cut down the convex lens so that a profile might become abbreviation rectangle-like was arranged in the shape of [of m'line xn' train] an array. The convex is arranged by the whole surface of fly eye lens 2a and 2b, and other sides are flat sides. The area of fly eye lens 2a and the whole 2b is equal to the light emitting device array 1, and the number of small lens 2c and an array consist of these operation gestalten so that it may become equal to the number of light emitting device 1a in the light emitting device array 1, and an array. That is, each light emitting device 1a in the light emitting device array 1, fly eye lens 2a, and each small lens 2c in 2b correspond by 1 to 1. Fly eye lens 2a of drawing 3 and 2b show the example of the same five-line four trains as the light emitting device array 1.
[0010] In this invention, 1st fly eye lens 2a and 2nd fly eye lens 2b are used as a pair. Incidence of the light to which outgoing radiation of fly eye lens 2a of this pair and the 2b is carried out from the light emitting device array 1 is carried out to 1st fly eye lens 2a, and it is arranged so that the division light divided into the rectangle light beam by each smallness lens 2c of 1st fly eye lens 2a may be condensed by the small lens of 2nd fly eye lens 2b, respectively. With this operation gestalt, both location is set up so that it may overlap, when opposite arrangement of these is carried out using fly eye lens 2a of a pair, and what has the magnitude and the number the same as 2b of small lens 2c and each smallness lens 2c of 1st fly eye lens 2a and each smallness lens 2c of 2nd fly eye lens 2b carry out plane view. The field which has the convex of 1st fly eye lens 2a is allotted so that the luminescence side of the light emitting device array 1 may be countered, with this operation gestalt, it is allotted so that the flat side of 1st fly eye lens 2a and the flat side of 2nd fly eye lens 2b may counter mutually, but opposite arrangement can be carried out so that the fields which have both convex may face each other. Moreover, the rectangle light beam by which outgoing radiation is carried out from the each smallness lens 2c laps with the light modulation field of a liquid crystal panel 4, and 2nd fly eye lens 2b is arranged so that image formation may be carried out. Here, as for the configuration of the rectangle light beam by which outgoing radiation is carried out from fly eye lens 2a and each smallness lens 2c of 2b, it is desirable

that it is the configuration and analog of a light modulation field of a liquid crystal panel 4 which are mentioned later, therefore it is [the flat-surface configuration of small lens 2c] desirable that it is the configuration and analog of a light modulation field of a liquid crystal panel 4. In addition, although two lenses 3a and 3b are arranged between 2nd fly eye lens 2b and a liquid crystal panel 4 with this operation gestalt in order to stop the breadth of the rectangle light beam from each smallness lens 2c of 2nd fly eye lens 2b and to make the light modulation field of the liquid crystal panel 4 which is small area comparatively carry out image formation efficiently, it is also possible to consider as the configuration which does not form these two lenses 3a and 3b.
[0011] Drawing 4 and drawing 5 are sectional views which meet the top view having shown an example of a liquid crystal panel 4, and its H-H' line, respectively. The liquid crystal panel 4 of this example counters with the active-matrix substrate 51, the opposite substrate 52 is arranged, between these substrates 51 and 52, liquid crystal 53 is enclosed and pinched and the outline configuration is carried out. The light-shielding film 56 of the shape of a frame for abandoning and carrying out a counterelectrode 55 and a viewing area on the insulating substrate 54 with transparent quartz substrate, high heat-resisting glass substrate, etc. is formed, and the opposite substrate 52 is constituted. The active-matrix substrate 51 and the opposite substrate 52 are stuck through a predetermined gap by the sealing layer 57 which used the sealant of gap material content. As a sealing layer 57, the sealant which made an epoxy resin, various kinds of ultraviolet-rays hardening resin, etc. contain the fiber or ball of inorganic [about 2 micrometers - about 10 micrometers] or the quality of organic as gap material can be used. The area of the opposite substrate 52 is smaller than the area of the active-matrix substrate 51, and the circumference part of the active-matrix substrate 51 is stuck on the condition of having overflowed from the periphery edge of the opposite substrate 52. On the active-matrix substrate 51 outside the opposite substrate 52, it **** for connecting the scanning-line drive circuit 61, the data-line drive circuit 62, an input/output terminal 63, the scanning-line drive circuit 61, and the data-line drive circuit 62 to an input/output terminal 63, and wiring 64 is arranged. Wiring connection of the flexible printed circuit board 65 is made at an input/output terminal 63. moreover, the sealing layer 57 -- a part -- breaking off -- **** -- this -- it breaks off and the part serves as the liquid crystal inlet 58. Therefore, after sticking the opposite substrate 52 and the active-matrix substrate 51, reduced pressure impregnation of the liquid crystal 53 can be carried out inside a sealing layer 57 from the liquid crystal inlet 58 by changing the inside field of a sealing layer 57 into a reduced pressure condition. After the liquid crystal inlet 58 encloses liquid crystal 53, the closure of it is carried out with encapsulant 59. In addition, the sign 60 in drawing 5 is a pixel electrode, and each pixel electrode corresponds to each pixel in a liquid crystal panel 4.
[0012] In the light modulation equipment of this operation gestalt, between the incidence sides of a liquid crystal panel 4, i.e., a liquid crystal panel 4 and lens 3b, the incidence side polarizing plate (illustration abbreviation) is arranged, and the outgoing radiation side polarizing plate (illustration abbreviation) is arranged between the outgoing radiation sides 5 of a liquid crystal panel 4, i.e., a liquid crystal panel 4 and a projection lens system. For example, the incidence side polarizing plate is set up in the direction of s-polarized light, and the transparency shaft penetrates only s-polarized light among the light source light irradiated from lens 3b, and carries out outgoing radiation of it towards a liquid crystal panel 4. A liquid crystal panel 4 modulates the polarization direction of the polarization light by which outgoing radiation was carried out from the incidence side polarizing plate according to the picture signal given from the light modulation equipment driving means 7. Such light modulation is performed in the field in which the pixel is arranged in the liquid crystal panel 4, and calls this field a light modulation field on these specifications. Moreover, the transparency shaft is set up in the direction of p-polarized light, and an outgoing radiation side polarizing plate penetrates only p-polarized light light among the modulation light by which outgoing radiation was carried out from the liquid crystal panel 4. Thereby, light modulation equipment has the function which modulates incident light according to the image information given from the light modulation equipment driving means 7, and forms an image. And the light which penetrated the outgoing radiation side polarizing plate of light modulation equipment is projected on the projection screen 10 by the projection lens system 5, and an image is displayed on a screen 10.
[0013] The light source driving means 6 and the light modulation equipment driving means 7 are controlled by the control means 8, and it consists of these operation gestalten so that the timing which makes light emitting device 1a from which the luminescent color differs in the light emitting device array 1 emit light, and the timing which switches the image display which can be set liquid crystal panel 4 may be synchronized. Therefore, it can project on a screen 10, changing the image of each colored light at high speed carrying out incidence to the liquid crystal panel 4 of light modulation equipment changing each colored light of three colors of R, G, and B at high speed. And since it is mixed on the retina of those who see and the image of three colors which change at

high speed is perceived as a color of arbitration, a color display image is realized.
[0014] According to this operation gestalt, since the light emitting device array 1 is used as the light source, compared with the projection mold display which used the conventional halogen lamp etc. for the light source, the light source is small, it is light, and the high-voltage circuit for a halogen lamp drive is also unnecessary. Therefore, drive power can also be reduced while being able to attain miniaturization of the whole projection mold display, and lightweight-ization. Moreover, it is also easy to increase brightness while sufficient brightness is secured, since what arranged two or more light emitting devices in the shape of an array as the light source is used. Moreover, since a profile is divided into two or more partitions of an abbreviation rectangle, and each partition is overlapped on the whole modulation field of a liquid crystal panel, respectively and is irradiated by fly eye lens 2a and 2b, even if light source light has brightness nonuniformity and color nonuniformity in each partition, it can obtain a projection image without brightness nonuniformity and color nonuniformity. Moreover, each light emitting device 1a and fly eye lens 2a, [in / at this operation gestalt / the light emitting device array 1] Since the light to which each small lens 2c in 2b supports by 1 to 1, and outgoing radiation is carried out from each light emitting device 1a is irradiated by the whole light modulation field of a liquid crystal panel 4, respectively Even if the brightness of each light emitting device 1a is not uniform, on a liquid crystal panel, it becomes uniform brightness and the high projection image of little display grace of brightness nonuniformity is obtained. Moreover, with this operation gestalt, in the light emitting device array 1, light emitting device 1ar from which the luminescent color differs, 1ag, and 1ab are arranged, and while carrying out sequential luminescence of these light emitting device 1ar(s), 1ag, and the 1ab for every luminescent color, it consists of liquid crystal panels 4 so that different light modulation for every luminescent color may be given. Therefore, since it can change by switching electrically the driving signal to the light emitting device array 1, without depending the color of the light source light by which incidence is carried out to a liquid crystal panel 4 on the method using the conventional color wheel, a high-speed response is possible. Moreover, since a color wheel is not used, the use effectiveness of light source light is high, while bright color display is possible, without causing increase of power consumption, there is also no generating of a sound at the time of projection, and quiet equipment is obtained. Moreover, with this operation gestalt, in the luminescence side of the light emitting device array 1, although the luminescence locations of RGB each color differ, since it is superimposed on the luminescence light from each light emitting device 1a on the light modulation field of a liquid crystal panel 4, a gap of the color by the difference in a luminescence location does not arise. for example, the same image -- R, G, and B -- although the luminescence locations of RGB [in / in three images displayed and obtained only in each Isshiki / the light emitting device array 1] differ, respectively, a gap is not produced among these images. Furthermore, since the projection mold display of this operation gestalt can arrange linearly the member of the optical system which constitutes equipment, it can design the whole equipment in a compact.
[0015] In addition, the array of light emitting device 1ar of each luminescent color on the light emitting device array 1 (R, G, B), 1ag, and 1ab can be suitably changed not only in the example of this operation gestalt. Moreover, when it may not be uniform and plane view of the light emitting device array 1 and fly eye lens 2a, and the 2b is carried out, the core of small lens 2c and the location of the array pitch of light emitting device 1a in the light emitting device array 1 of light emitting device 1a do not need to correspond. By shifting the location of light emitting device 1a, the brightness nonuniformity in the light modulation field of a liquid crystal panel 4 can also be adjusted. Furthermore, since it is superimposed on the light of each partition divided by 1st fly eye lens 2a on the light modulation field of a liquid crystal panel 4 If it is in the condition that the brightness nonuniformity of one partition, color nonuniformity and the brightness nonuniformity of other partitions, and color nonuniformity compensate each other, and are equalized even if brightness nonuniformity and color nonuniformity are in each partition, brightness nonuniformity and color nonuniformity will be reduced in a projection image. Therefore, the number and array (m, n) of light emitting device 1a in the light emitting device array 1, The number of fly eye lens 2a and small lens 2c in 2b, an array (m', n') and the luminescence area of the light emitting device array 1, and the area of fly eye lens 2a and the whole 2b Although it is desirable that it is in agreement, respectively, even if not necessarily in agreement, it is possible to acquire the high image of little display grace of brightness nonuniformity and color nonuniformity.
[0016] Moreover, the luminescence reinforcement of each light emitting device does not need to be equal. When what has low luminescence reinforcement is arranged in the array location near the center section of the light emitting device array and luminescence reinforcement arranges a high thing in the array location near the periphery section, the homogeneity of the optical reinforcement irradiated on light modulation equipment can be raised. Moreover, although what was equipped with the liquid crystal panel of a transparency mold as light

modulation equipment was used with this operation gestalt, it is also possible to use the thing equipped with the liquid crystal panel of a reflective mold. Furthermore, although fly eye lens 2a of a pair and 2b were used as an optical diffusion means with this operation gestalt An optical diffusion means that what is necessary is just to have the function to which the light by which outgoing radiation is carried out from each light emitting device 1a is made to irradiate the whole light modulation field of light modulation equipment, respectively It is also possible to use one or three fly eye lens 2a or more, and 2b, and it is also possible to use combining fly eye lens 2a, 2b, and other optical elements.

[0017] Next, the 2nd operation gestalt of this invention is explained. Drawing 6 is the outline block diagram having shown the 2nd operation gestalt of the projection mold display of this invention. In this drawing, the same sign is given to the same component as drawing 1 , and that explanation is omitted. The point that the equipment of this operation gestalt differs from the equipment of the operation gestalt of the above 1st greatly While making each light emitting device array 11r, 11g, and 11b counter and allotting fly eye lens 12of ** three 1st a using the light emitting device arrays 11r, 11g, and 11b which are three from which the luminescent color differs, respectively as the light source 2nd fly eye lens 12b is the point of having used only one and having established the light guide means 20 between three fly eye lens 12a and fly eye lens 12of ** one 2nd b.

[0018] On one light emitting device array, as for the light emitting device arrays 11r, 11g, and 11b by which the light emitting device array 1 in the operation gestalt of the above 1st is used with this operation gestalt to light emitting device 1a from which the luminescent color differs being allotted on one light emitting device array 1, two or more light emitting devices with the same luminescent color are allotted. That is, two or more red light emitting device 1ar(s) are arranged [the luminescent color] for the luminescent color by red (R) light emitting device array 11r in the shape of [of a m line xn train] an array. the luminescent color is green similarly -- light emitting device 1ag with the green luminescent color to light emitting device array 11g of (G) is arranged in the shape of [of a m line xn train] an array, and the luminescent color is green -- blue light emitting device 11ab is arranged for the luminescent color by light emitting device array 11b of (B) in the shape of [of a m line xn train] an array. the same thing as the operation gestalt of the above 1st uses light emitting device 11ar of each color (R, G, B), 11ag, and 11ab -- having -- each -- from light emitting device 11ar, 11ag, and 11ab, an almost parallel light carries out outgoing radiation toward 1st fly eye lens 12a. Moreover, light emitting device 11ar in each light emitting device arrays 11r, 11g, and 11b, While flashing of 11ag(s) and 11ab is performed by the electrical signal from the light source driving means 16 and two or more light emitting device 11ar(s) (11ag, 11ab) on [of one] light emitting device array 11r (11g, 11b) blink all at once Three light emitting device arrays 11r, 11g, and 11b are controlled to carry out sequential luminescence. the function as the 1st and 2nd fly eye lenses in the operation gestalt of the above 1st that the 1st and 2nd fly eye lenses 12a and 12b are the same respectively -- having -- **** -- this operation gestalt -- three fly eye lens 12a -- respectively -- ** -- fly eye lens 12of ** one 2nd b is making the pair, respectively. Moreover, opposite arrangement is carried out so that each small lens 2c in each light emitting device 11ar, 11ag, 11ab, and fly eye lenses 12a and 12b may correspond by 1 to 1. And incidence of the light by which outgoing radiation is carried out from three light emitting device arrays 11r, 11g, and 11b is carried out to 1st fly eye lens 12a which has countered each, and it is arranged so that the division light divided into the rectangle light beam by each smallness lens 2c of 1st fly eye lens 12a may be condensed by the small lens of 2nd fly eye lens 2b through the light guide means 20, respectively. In addition, although the light guide means 20 has been arranged between 1st fly eye lens 12a and 2nd fly eye lens 12b, it is also possible the 1st fly eye lens, fly eye lens of ** 2nd 12b, and to arrange subsequently to the order of the light guide means 20 here. In this case, since distance from a light guide means to light modulation equipment can be shortened, it becomes advantageous to small.

[0019] With this operation gestalt, the cross dichroic prism 20 is used that the light guide means 20 should just be what has the function to lead three optical paths of the light by which outgoing radiation is carried out, respectively from three light emitting device arrays 11r, 11g, and 11b to a single optical path. The cross dichroic prism 20 is formed so that the dielectric multilayers which reflect red sunset alternatively, and the dielectric multilayers which reflect a blue light alternatively may become the interface of four rectangular prisms with the shape of an abbreviation X character. And three 1st fly eye lens 12a and three light emitting device arrays 11r, 11g, and 11b are allotted in order, and 2nd fly eye lens 12b is arranged so that the end face of the remaining one directions may be countered, so that the end face of three directions may be countered, respectively among the end faces of four different directions which cross at the include angle of 45 degrees to the field in which the dielectric multilayers of this cross dichroic prism 20 are formed. In this operation gestalt, it is allotted so that the optical axis of 2nd fly eye lens 12b and a light emitting device array 11g [of green (G)] optical axis

may lap. After being divided by 1st fly eye lens 12a, **** by which outgoing radiation was carried out from light emitting device array 11g of green (G) is constituted so that each division light may penetrate the cross dichroic prism 20 and may be condensed by each smallness lens 12c of 2nd fly eye lens 12b, respectively. Moreover, the red sunset by which outgoing radiation was carried out from red (R) light emitting device array 11r It is constituted so that it may be reflected with the cross dichroic prism 20 and each division light may be condensed by each smallness lens 12c of 2nd fly eye lens 12b, respectively, after being divided by 1st fly eye lens 12a. After being divided by 1st fly eye lens 12a, **** by which outgoing radiation was similarly carried out from blue (B) light emitting device array 11b is constituted so that it may be reflected with the cross dichroic prism 20 and may be condensed by each smallness lens of 2nd fly eye lens 12b, respectively.

[0020] The rectangle light beam by which outgoing radiation is carried out from each smallness lens 2c of 2nd fly eye lens 2b laps with the light modulation field of a liquid crystal panel 4, and 2nd fly eye lens 2b and two lenses 3a and 3b are arranged so that image formation may be carried out. Moreover, the light source driving means 16 and the light modulation equipment driving means 7 are controlled by the control means 8, and it is constituted so that the timing in which three light emitting device arrays 11r, 11g, and 11b carry out sequential luminescence, and the timing which switches the image display which can be set liquid crystal panel 4 can be synchronized. While each colored light of three colors of R, G, and B changes at high speed, incidence is carried out to the liquid crystal panel 4 of light modulation equipment by this, and the image of each colored light changes at high speed, a color display image is realized by being projected on a screen 10.

[0021] According to this operation gestalt, like the operation gestalt of the above 1st, since the light emitting device array 1 is used as the light source Since reduction-ization of miniaturization [of a projection mold display], lightweight-izing, and drive power can be attained and light source light is irradiated through fly eye lens 2a and 2b at a liquid crystal panel 4 Since three light emitting device arrays 1 are used as the light source for the high projection image of little display grace of brightness nonuniformity and color nonuniformity being obtained, and also irradiating light at one liquid crystal panel 4 It has the advantage that the gross area of a luminescence side is large, there are also many exposures to a liquid crystal panel 4, and a bright projection image is obtained.

[0022] In addition, although equipment can be comparatively constituted from this operation gestalt in a compact since the cross dichroic prism 20 was used as a light guide means, a light guide means can also be constituted from three light emitting device arrays 11r, 11g, and 11b using optical elements other than cross dichroic prism 20 that what is necessary is just what has the function to lead the light by which outgoing radiation is carried out, respectively to a single optical path.

[0023]

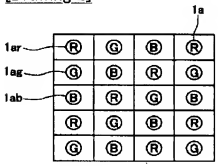
[Effect of the Invention] As explained above, while according to this invention securing sufficient brightness and obtaining a bright image by using a light emitting device array as the light source, reduction-ization of miniaturization [of a projection mold display], lightweight-izing, and drive power can be attained. Moreover, the high projection image of little display grace of brightness nonuniformity and color nonuniformity can be obtained by making the light by which outgoing radiation is carried out from each light emitting device of a light emitting device array superimpose on the whole light modulation field of light modulation equipment using an optical diffusion means, respectively. Furthermore, since it can change by switching electrically the driving signal to a light emitting device array, without depending the color of the light source light which carries out incidence to light modulation equipment on the method using the conventional color wheel, while a high-speed response is possible, there is also no generating of a sound at the time of projection, and quiet equipment is obtained. Moreover, the use effectiveness of light source light improves, and bright color display becomes possible, without causing increase of power consumption.

[Translation done.]

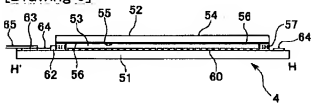
* NOTICES *

DRAWINGS

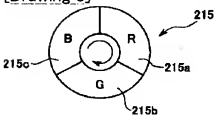
[Drawing 2]



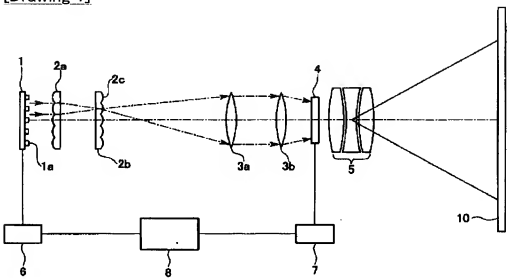
[Drawing 5]



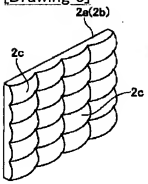
[Drawing 8]



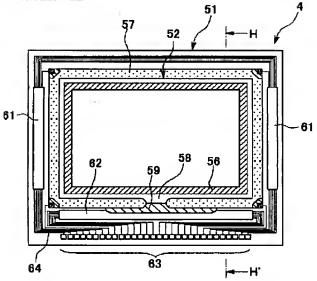
[Drawing 1]



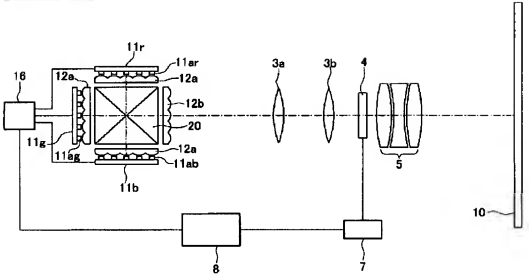
[Drawing 3]



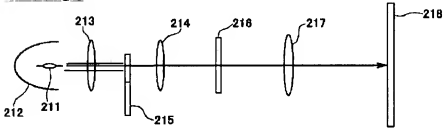
[Drawing 4]



[Drawing 6]



[Drawing 7]



[Translation done.]